

# **DC Electronic Load**

PEL-3000

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## **PROGRAMMING MANUAL**

VERSION: 1.11



ISO-9001 CERTIFIED MANUFACTURER

**GW INSTEK**

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# INTERFACE OVERVIEW

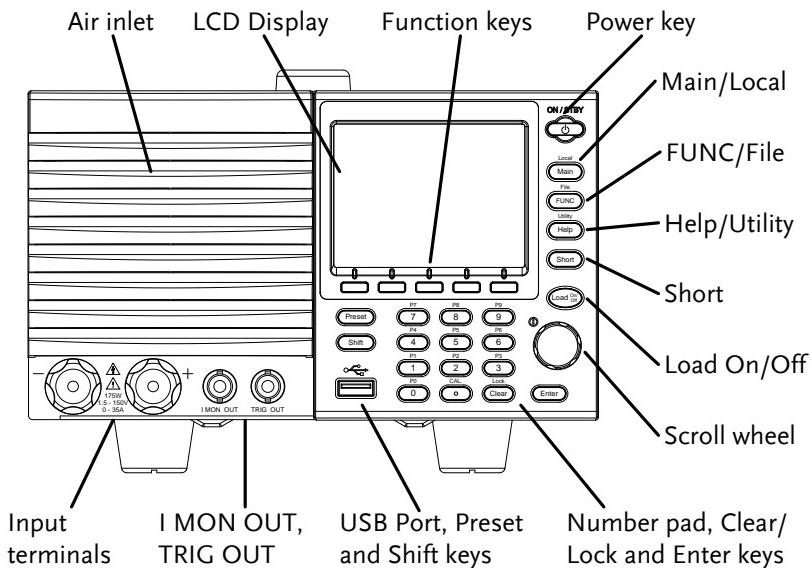
This chapter describes basic configuration of IEEE488.2 based remote control.

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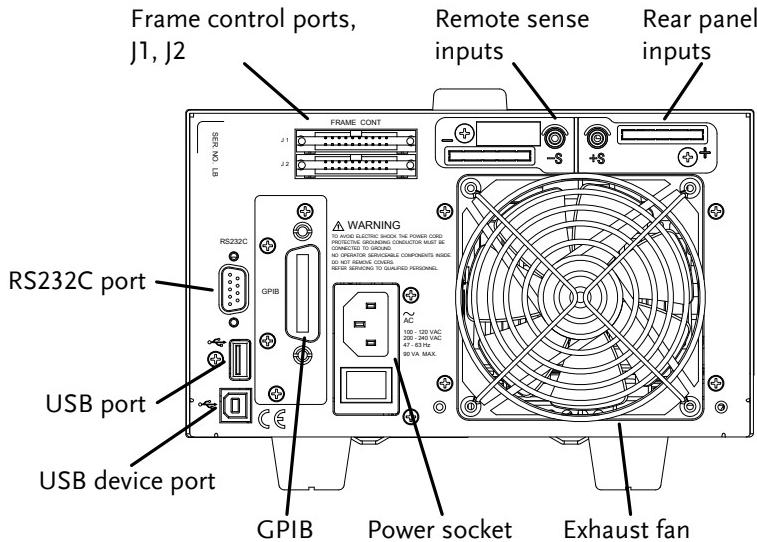
## Front Panel Overview

(PEL-3021/PEL-3041 shown)



## Rear Panel Overview

(PEL-3021 / PEL-3041 shown)



# Interface Configuration

## Configure to USB Remote Interface

---

USB configuration	PC side connector	Type A, host
	PEL-3000 side connector	Rear panel Type B, slave
Speed		2.0 (full speed)
USB Class		USB CDC AMC

---



### Note

Before USB can be used for remote control, it is necessary to install the PEL-3000 USB device driver, located on the accompanying User Manual CD.

---

### Operation

1. Connect the USB cable to the rear panel USB B port.
2. Press **Shift** + **Utility** **Help** > *Interface*[F3] and set the *Interface* setting to *USB*.

## Configure GPIB Interface

To use GPIB, the optional GPIB port must be installed. See the user manual for details.

---

### Operation

1. Ensure the PEL-3000 is off before proceeding.
2. Connect a GPIB cable from a GPIB controller to the GPIB port on the PEL-3000.
3. Turn the PEL-3000 on.

4. Press **Shift** + **Utility** **Help** > *Interface[F3]* and set the *Interface* setting to *GPIB*.
5. Set the GPIB address.

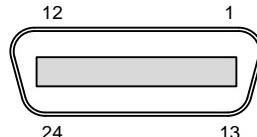
GPIB address      0~30

---

### GPIB constraints

- *Maximum 15 devices altogether, 20m cable length, 2m between each device*
- *Unique address assigned to each device*
- *At least 2/3 of the devices turned On*
- *No loop or parallel connection*

### Pin Assignment



Pin	Signal	Pin	Signal
1~4	Data I/O 1~4	13~16	Data I/O 5~8
5	EOI	17	REN
6	DAV	18	Ground (DAV)
7	NRFD	19	Ground (NRFD)
8	NDAC	20	Ground (NDAC)
9	IFC	21	Ground (IFC)
10	SRQ	22	Ground (SRQ)

11	ATN	23	Ground (ATN)
12	SHIELD Ground	24	Single GND

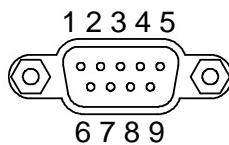
## Configure RS232C

RS232C Configuration	Connector	DB-9, Male
	Baud Rate	2400, 4800, 9600, 19200, 38400
	Stop Bit	1, 2
	Parity	None, Odd, Even

Operation      1. Connect an RS232C cable from the PC to the rear panel RS232 port.

- Utility
2. Press **Shift** + **Help** > *Interface[F3]* and set the *Interface* setting to *RS232*.
3. Set the *Baud Rate*, *Stop Bit* and *Parity* settings.

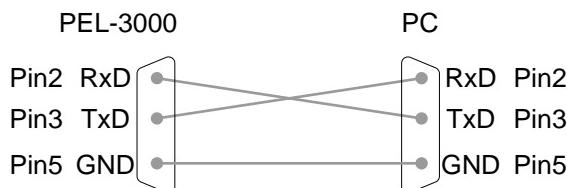
### Pin Assignment



- 2: RxD (Receive data)  
3: TxD (Transmit data)  
5: GND  
4, 6 ~ 9: No connection

### PC Connection

Use a null modem connection as shown in the diagram below.



## RS232C/USB Remote Control Function Check

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### Functionality check

Invoke a terminal application such as RealTerm. For RS232C, set the COM port, baud rate, stop bit, data bit and parity accordingly.

To check the COM settings, see the Device Manager in the PC. For WinXP; Control panel → System → Hardware tab.

---

Run this query command via the terminal after the instrument has been configured for RS232/USB remote control (page 5).

\*idn?

This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format.

- *GW-INSTEK, PEL-3000, XXXXXXXXXXXX,  
V.X.X.X*

Manufacturer: GW-INSTEK

Model number : PEL-3000

Serial number : XXXXXXXXXXXX

Firmware version : V.X.X.X

## Using Realterm to Establish a Remote Connection

---

### Background

Realterm is a terminal program that can be used to communicate with a device attached to the serial port of a PC or via an emulated serial port via USB.

The following instructions apply to version 1.99.0.27. Even though Realterm is used as an example to establish a remote connection, any terminal program can be used that has similar functionality.

---



### Note

Realterm can be downloaded on Sourceforge.net free of charge.

For more information please see  
<http://realterm.sourceforge.net/>

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### Operation

1. Download Realterm and install according to the instructions on the Realterm website.
2. Connect the PEL-3000 via USB (page 5) or via RS232 (page 7).
3. If using RS232, make note of the configured baud rate, stop bits and parity.
4. Go to the Windows device manager and find the COM port number for the connection.  
For example, go to the Start menu > Control Panel > Device Manager

Double click the *Ports* icon to reveal the connected serial port devices and the COM port for each connected device.

If using USB, the baud rate, stop bit and parity settings can be viewed by right-clicking the connected device and selecting the *Properties* option.



5. Start Realterm on the PC as an administrator.  
Click:  
Start menu>All Programs>RealTerm>realterm

Tip: to run as an administrator, you can right click the Realterm icon in the Windows Start menu and select the *Run as Administrator* option.

- After Realterm has started, click on the *Port* tab.

Enter the *Baud*, *Parity*, *Data bits*, *Stop bits* and *Port number* configuration for the connection.

The *Hardware Flow Control*, *Software Flow Control* options can be left at the default settings.

Press *Open* to connect to the PEL-3000.

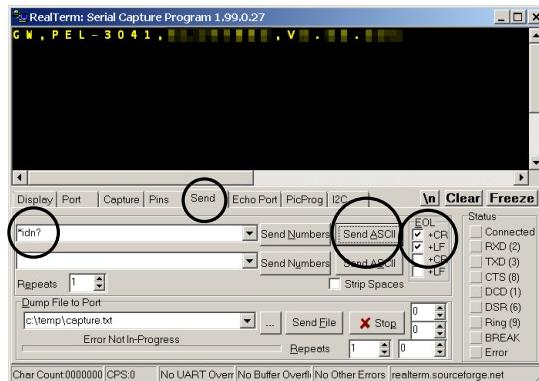


7. Click on the *Send* tab.

In the *EOL* configuration, check on the *+CR* and *+LF* check boxes.

Enter the query:  
*\*idn?*

Click on *Send ASCII*.



8. The terminal display will return the following:

*GW, PEL-3XXX,EXXXXXXX,VX.XX.XXX*

(manufacturer, model, serial number, version)

9. If Realterm fails to connect to the PEL-3000, please check all the cables and settings and try again.

## GPIB Function Check

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### Functionality check

Please use the National Instruments Measurement & Automation Controller software to confirm GPIB/LAN functionality.

See the National Instrument website,  
<http://www.ni.com> for details.

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### Operation

1. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:

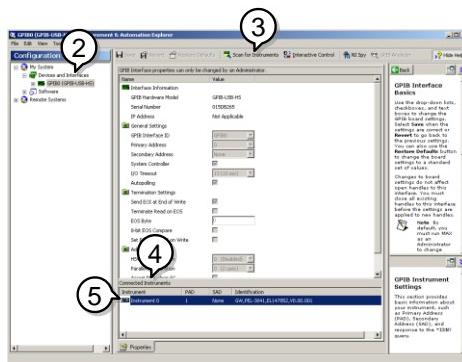


*Start>All Programs>National Instruments>Measurement & Automation*



2. From the Configuration panel access;  
My System>Devices and Interfaces>GPIB0

3. Press the *Scan for Instruments* button.
4. In the *Connected Instruments* panel the PEL-3000 should be detected as *Instrument 0* with the address the same as that configured on the PEL-3000.
5. Double click the *Instrument 0* icon.



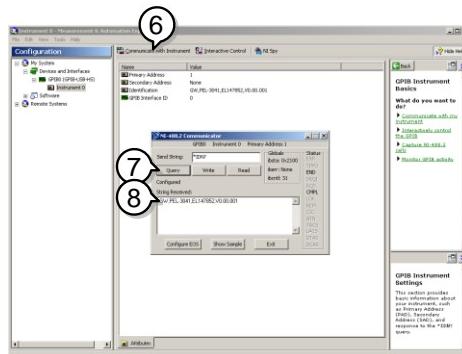
6. Click on *Communicate with Instrument*.
7. In the *NI-488.2 Communicator* window, ensure *\*IND?* is written in the *Send String:* text box.

Click on the *Query* button to send the *\*IDN?* query to the instrument.

8. The *String Received* text box will display the query return:

*GW, PEL-3XX,EXXXXXXX,VX.XX.XXX*

(manufacturer, model, serial number, version)



9. The function check is complete.

# COMMAND OVERVIEW

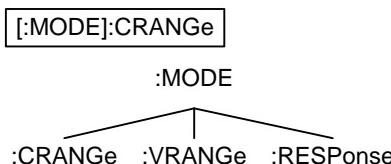
The Command overview chapter lists all PEL-3000 commands in functional order as well as alphabetical order. The command syntax section shows you the basic syntax rules you have to apply when using commands.

## Command Syntax

---

Compatible Standard	IEEE488.2 SCPI, 1999	Partial compatibility Partial compatibility
Command Structure	SCPI (Standard Commands for Programmable Instruments) commands follow a tree-like structure, organized into nodes. Each level of the command tree is a node. Each keyword in a SCPI command represents each node in the command tree. Each keyword (node) of a SCPI command is separated by a colon (:).	

For example, the diagram below shows an SCPI sub-structure and a command example.



Command types	There are a number of different instrument commands and queries. A command sends instructions or data to the unit and a query receives data or status information from the unit.	
Command types		
Simple	A single command with/without a parameter	
Example	:CONFigure:RESPonse MAX	
Query	A query is a simple or compound command followed by a question mark (?). A parameter (data) is returned.	
Example	:CONFigure:RESPonse?	
Compound	Two or more commands on the same command line. Compound commands are separated with either a semi-colon (;) or a semi-colon and a colon (;:).	
	A semi-colon is used to join two related commands, with the caveat that the last command must begin at the last node of the first command.	
	A semi-colon and colon are used to combine two commands from different	

nodes.

Example	CONFigure:VON MAX;:CONFigure:VDELay MIN
---------	---

---

#### Command Forms

Commands and queries have two different forms, long and short. The command syntax is written with the short form of the command in capitals and the remainder (long form) in lower case.

The commands can be written in capitals or lower-case, just so long as the short or long forms are complete. An incomplete command will not be recognized.

Below are examples of correctly written commands.

---

Long form	:CURREnt:LEVel? :CURRENT:LEVEL? :current:level?
Short form	:CURREnT:LEV? :curr:lev?

---

---

#### Square Brackets

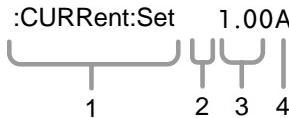
Commands that contain square brackets indicate that the contents are optional. The function of the command is the same with or without the square bracketed items, as shown below

For example for the query:  
“[:CONFigure]:GNG [:PASS]?”

Both “:CONFigure:GNG:PASS?” and “:GNG?” are both valid forms.

---

## Command Format



- |                   |                    |
|-------------------|--------------------|
| 1. Command header | 3. Parameter 1     |
| 2. Space          | 4. Unit or suffix. |

Common Input Parameters	Type	Description	Example
	<Boolean>	boolean logic	0, 1
	<NR1>	integers	0, 1, 2, 3
	<NR2>	decimal numbers	0.1, 3.14, 8.5
	<NR3>	floating point	4.5e-1, 8.25e+1
	<NRf>	any of NR1, 2, 3	1, 1.5, 4.5e-1
	[MIN] (Optional parameter)	For commands, this will set the setting to the lowest value. This parameter can be used in place of any numerical parameter where indicated.	
		For queries, it will return the lowest possible value allowed for the particular setting.	
	[MAX] (Optional parameter)	For commands, this will set the setting to the highest value. This parameter can be used in place of any numerical parameter where indicated.	
		For queries, it will return the highest possible value allowed for the particular setting.	
Unit Suffixes (Optional parameters)		Unit suffixes can be optionally used with most NRf type input parameters.	

[A]	Amps	1.00A
[%]	Percentage	10%
[V]	Volts	5.00V
[W]	Watts	3.00W
[mS]	milliseconds	20mS
[mV]	Millivolts	150mV
[S]	Seconds	5S
[MHO]	Reciprocal of one ohm	0.02MHO
[mA/uS]	Millamps/ microsecond	100mA/uS
[Hz]	Hertz	1000Hz

---

Message Terminator	LF	Line feed code (0x0A)
-----------------------	----	-----------------------

---

## Command List

---

Common Commands	*CLS .....	25
	*ESE .....	25
	*ESR? .....	26
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## Common Commands

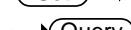
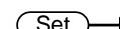
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*RCL.....	27
*RST.....	27
*SAV.....	28
*SRE .....	28
*STB? .....	29
*TRG.....	29
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### \*CLS



Description      Clears the error queue.

Query Syntax    \*CLS



### \*ESE

Description      Queries or sets the Standard Event Status Enable register. The Standard Event Status Enable register determines which events can set the Event Summary bit (ESB) in the Status Byte Register. Any bits that are set to 1 enable the corresponding event. Each event is represented by a bit in the Standard Event Status Enable register.

Syntax            \*ESE <NR1>

Query Syntax    \*ESE?

Parameter/ Return parameter	<NR1> (bit weight)	Bit number / Description
	4	3 / QYE
	8	4 / DDE
	16	5 / EXE
	32	6 / CME

---

Example      \*ESE 8

Sets bit 4 of the ESE register.

---

Query example      \*ESE?  
                      >12

Bits 3 and 4 are set in the Standard Event Status  
Enable register.

---

### \*ESR?

---

→  **Query**

Description      Reads the Standard Event Status register. This  
command will also clear the Standard Event Status  
register.

---

Query Syntax      \*ESR?

---

Return parameter	<NR1> (bit weight)	Bit number / Description
	4	3/ QYE
	8	4/ DDE
	16	5/ EXE
	32	6/ CME

---

Query example      \*ESR?  
                      >48

Bits 5 and 6 are set in the Standard Event register.

---

### \*IDN?

---

→  **Query**

Description      Queries the manufacturer, model number, serial  
number, and firmware version of the instrument.

---

Query Syntax      \*IDN?

---

Return parameter	<string>	Returns the instrument identification as a string in the following format:  GW-INSTEK, PEL-3021, XXXXXXXX, V.VV  Manufacturer: GWINSTEK Model number : PEL-3021 Serial number : XXXXXXXX Firmware version : V.VV
------------------	----------	--

**\*OPC**

Description	This command sets the OPC (Operation Command Bit) bit (bit 0) of the Standard Event Status Register after the instrument has completed all pending operations. The query will return the status of the OPC bit.	
-------------	---	--

Syntax	*OPC	
--------	------	--

Query Syntax	*OPC?	
--------------	-------	--

Return parameter	<NR1>	
	1	Operation complete

Query Example	*OPC?
	>1

Indicates that all pending operations are complete.

**\*RCL**

Description	The Recall Instrument State command restores the instrument settings from a previously saved memory setting.	
-------------	--	--

Syntax	*RCL <NR1>	
--------	------------	--

Parameter	<NR1>	
	1~256	Memory number 1 to 256

Example	*RCL 20	
	Recall setting memory 20.	

**\*RST**

Description	Resets the unit. This command forces the ABORT, and *CLS	
-------------	--	--

Query Syntax	*RST	
--------------	------	--

**\*SAV**

**Description** The Save Instrument State command saves the instrument settings to one of the memory setting slots.

**Syntax** \*SAV <NR1>

<b>Parameter</b>	<NR1>	1~256	Memory number 1 to 256
------------------	-------	-------	------------------------

**Example** \*SAV 20

Saves the current setting to memory 20.

**\*SRE**

**Description** Queries or sets the Service Request Enable register. The Service Request Enable register determines which events in the Status Byte register can set the Master Summary bit (MSB) in the Status Byte Register. Any bits that are set to 1 will cause the MSS bit to be set.

**Syntax** \*SRE <NR1>

**Query Syntax** \*SRE?

Parameter/ Return parameter	<NR1> (bit weight)	Bit number / Description
	1	1/Not used
	2	2/ERR
	4	3/ CSUM
	8	4/ QUES
	16	5/ MAV
	32	6/ ESB
	64	7/ RQS_MSS
	128	8/ OPER

Note: Bit 1 and 2 cannot be set, however bit 2 (ERR) can be returned.

**Example** \*SRE 8

Sets bit 4 of the Service Request Enable register.

Query example    \*SRE?  
                     >12

Bits 3 and 4 are set in the Service Request Enable register.

### \*STB?

→ **Query**

Description         Reads the Status Byte register. This command will not clear the Status Byte register.  
                     If the Master Summary Status bit (MSS) is set, it indicates that there is a reason for a service request.

---

**Query Syntax**    \*STB?

Return parameter	<NR1> (bit weight)	Bit number / Description
1		1/Not used
2		2/ERR
4		3/ CSUM
8		4/ QUES
16		5/ MAV
32		6/ ESB
64		7/ RQS_MSS
128		8/ OPER

---

Note: Bit 1 and 2 cannot be set, however bit 2 (ERR) can be returned.

Query example    \*STB?  
                     >36

Bits 3 and 6 are set in the Status Byte register.

---

### \*TRG

→ **Set**

Description         This command triggers the unit.

---

**Query Syntax**    \*TRG

**\*TST?** → (Query)

---

**Description** This command is a standard SCPI self-test command. The PEL-3000 does not perform any self-tests so will always return 0 (pass) for this command.

**Query Syntax** \*TST?

**Return parameter** <NR1>  
0 Pass

**Query example** \*TST?  
>0

---

**\*WAI** →

---

**Description** Wait command. Prevents new operations from executing until all pending operations have finished.

**Query Syntax** \*TRG

## Trigger Commands

---

:ABORt .....

:INPut .....

:INPut:SHORt .....

**:ABORt** →

---

**Description** Turns the load off. (and the loads of all connected slave devices.)

**Query Syntax** :ABORT

**:INPut** →  


---

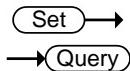
**Description** Sets or queries the status of the load.

---

Syntax	:INPut {<Boolean>} OFF   ON}	
Query Syntax	:INPut?	
Parameter parameter	OFF or 0 ON or 1	Load = OFF Load = ON
Return parameter	0 1	Load = OFF Load = ON
Example	:INPut ON Turns the load on.	
Query example	:INPut? >0 Indicates that the load is off.	

---

:INPut:SHORt




---

Description	Shorts or opens the input terminals or queries their status.	
Syntax	:INPut:SHORt {<Boolean>} OFF   ON}	
Query Syntax	:INPutSHORt?	
Parameter parameter	OFF or 0 ON or 1	Short = OFF Short = ON
Return parameter	0 1	Short = OFF Short = ON
Example	:INPut:SHORt ON Shorts the input terminals.	
Query example	:INPut:SHORt? >0 Indicates that the terminals are open.	

---

## Measurement Commands

---

:MEASure:CURRent? .....  
:MEASure:VOLTage? .....  
:MEASure:POWer? .....  
:MEASure:ETIMe? .....

### :MEASure:CURRent?

---

→  Query

Description	This command returns the load current.	
Query Syntax	:MEASure:CURRent?	
Return parameter	<NR2>	Load current in amps
Query example	<pre>:MEASure:CURRent? &gt;0.79860</pre> Returns the load current in amps.	

### :MEASure:VOLTage?

---

→  Query

Description	This command returns the load voltage.	
Query Syntax	:MEASure:VOLTage?	
Return parameter	<NR2>	Load voltage in volts
Query example	<pre>:MEASure:VOLTage? &gt;1.49900</pre> Returns the load voltage in volts.	

### :MEASure:POWer?

---

→  Query

Description	This command returns the power.	
Query Syntax	:MEASure:POWer?	
Return parameter	<NR2>	Power in watts
Query example	<pre>:MEASure:POWer? &gt;1.19695</pre> Returns the power in watts.	

**:MEASure:ETIME?** Query

---

Description      Returns the amount of time the load has been on for in seconds (elapsed time).

---

Query Syntax    :MEASure:ETIME?

---

Return parameter <NR2>                          Elapsed time in seconds

---

Query example    :MEASure:ETIME?  
                      >316.0

---

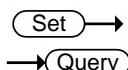
                      Returns the elapsed time in seconds.

---

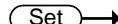
## Configure Subsystem Commands

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### [:CONFigure]:OCP



Description	Sets or queries the OCP trip settings. The OCP limit can be set to a specific value or the trip setting can be set to either limit the current or to turn the load off.	
Syntax	[:CONFigure]:OCP {<NR2>[ A ]   MINimum   MAXimum   LIMit   LOFF }	
Query Syntax	[:CONFigure]:OCP?	
Parameter	<NR2>[A]	Current limit value.

	MINIMUM or MIN	Minimum current limit value.
	MAXIMUM or MAX	MAXimum current limit value.
	LIMIT or LIM	Limit the load
	LOFF	Turn the load off
Return parameter	Returns a string with OPC setting followed by the OPC value.	
Example1	:OPC LIM	Sets the OCP setting to limit.
Example2	:OPC 77.000	Sets the OCP value to 77A.
Query example	:OPC? >LIMIT, 77.000	The OCP setting is LIMIT and the OPC value is 77.000A.
[ :CONFigure]:OPP		 Set  Query
Description	Sets or queries the OPP trip settings. The OPP limit can be set to a specific value or the trip setting can be set to either limit the power or to turn the load off.	
Syntax	[:CONFigure]:OPP {<NR2>[ W]   MINimum   MAXimum   LIMit   LOFF }	
Query Syntax	[:CONFigure]:OPP?	
Parameter	<NR2>[W] MINIMUM or MIN MAXIMUM or MAX LIMIT or LIM LOFF	Power limit value. MINIMUM power limit value. MAXIMUM power limit value. Limit the load Turn the load off
Return parameter	Returns a string with OPP setting followed by the OPP value.	

---

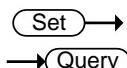
Example1 :OPP LIMIT  
Sets the OCP setting to limit.

---

Example2 :OPP 10.000  
Sets the OPP value to 10W.

---

Query example :OPP?  
>LIMIT, 10.000  
The OPP setting is LIMIT and the OPP value is 10.000W.



### [:CONFIGURE]:UVP

---

Description Sets or queries the UVP trip settings. The UVP can also be cleared with this command.

---

Syntax [:CONFIGURE]:UVP {<NR2>[ V ] |MINimum | MAXimum}

---

Query Syntax [:CONFIGURE]:UVP?

---

Parameter	<NR2>[V] MINIMUM or MIN	voltage limit value. MINIMUM value.
	MAXIMUM or MAX	MAXIMUM value.

---

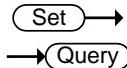
Return parameter Returns the UVP level (<NR2>)

---

Example1 :UVP 10.00  
Sets the UVP setting to 10V.

---

Query example :UVP?  
> 10.0000  
The UVP setting is 10.0000V.



### [:CONFIGURE]:OVP

---

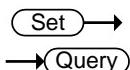
Description Sets or queries the OVP trip settings. The OVP can also be cleared with this command.

---

Syntax [:CONFIGURE]:OVP {<NR2>[ V ] | MINimum| MAXimum}

---

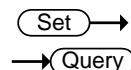
Query Syntax	[:CONFigure]:OVP?	
Parameter	<NR2>[V] MINIMUM or MIN MAXIMUM or MAX	voltage limit value. MINIMUM value. MAXIMUM value.
Return parameter	Returns the OVP level (<NR2>).	
Example1	:OVP 10.00 Sets the OVP setting to 10V.	
Query example	:OVP? > 10.0000 The OVP setting is 10.0000V.	



## [:CONFigure]:SSTart

Description	Sets or queries the Soft Start time setting.	
Syntax	[:CONFigure]:SSTart {<NR2>[ S]   MINimum  MAXimum   OFF}	
Query Syntax	[:CONFigure]:SSTart?	
Parameter	<NR2>[S] MINIMUM or MIN MAXIMUM or MAX OFF	The soft start time in seconds. Minimum time = 0 second Maximum time OFF = 0 second
Return parameter	<NR2> OFF	Returns the soft start time in seconds. Off
Example	:SSTart OFF Turns the soft start function off.	
Query example	:SSTart? >OFF The soft start function is off.	

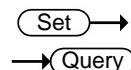
## [:CONFige]:VON



Description	Sets or queries the Von voltage settings.	
Syntax	[:CONFige]:VON {<NR2>[ V ]   MINimum   MAXimum   LON   LOFF }	
Query Syntax	[:CONFige]:VON?	
Parameter	<NR2>[ V ] MINIMUM or MIN MAXIMUM or MAX LON LOFF	The Von voltage level (default unit is V) Minimum Von voltage level Maximum Von voltage level Latch on Latch off
Return parameter	<ASCII string>	Returns the Von latch settings.
Example	:VON 10.0V	Sets the Von voltage to 10.0 volts.

Query example :VON?  
 >Latch OFF, 10.000  
 The Von voltage level is 10V.

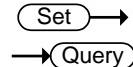
## [:CONFige]:VDELay



Description	Sets or queries the Von Delay settings in seconds.	
Syntax	[:CONFige]:VDELay <NR2>[S]   MINimum   MAXimum   OFF	
Query Syntax	[:CONFige]:VDELay?	
Parameter	<NR2>[ S ] OFF MINIMUM or MIN MAXIMUM or MAX	The delay time in seconds Disable the delay time Minimum delay time Maximum delay time
Return parameter	<NR2>	Returns the delay time in seconds

Example	:VDELay 1.5 mS Sets the delay time to 1.5mS. :VDELay 0.0015 S Sets the delay time to 1.5mS.										
Query example	:VDELay? >0.0015 The delay time is 1.5mS.										
	Set → → Query										
<b>:CONFigure:RESPonse</b>											
Description	Sets or queries the response speed. This is the equivalent to the CV Mode Response Speed or CC and CR Mode Response Speed settings on the front panel.										
Syntax	:CONFigure:RESPonse {<NR2>0.1  0.2   0.5   1.0  MINimum   MAXimum  FAST   SLOW}										
Query Syntax	:CONFigure:RESPonse?										
Parameter	<table border="1"> <tr> <td>&lt;NR2&gt;</td><td>0.1, 0.2, 0.5, 1.0 (for CC or CR mode only)</td></tr> <tr> <td>MINIMUM or MIN</td><td>Minimum response speed</td></tr> <tr> <td>MAXIMUM or MAX</td><td>Maximum response speed</td></tr> <tr> <td>FAST</td><td>Fast response speed (CV mode only)</td></tr> <tr> <td>SLOW</td><td>Slow response speed (CV mode only)</td></tr> </table>	<NR2>	0.1, 0.2, 0.5, 1.0 (for CC or CR mode only)	MINIMUM or MIN	Minimum response speed	MAXIMUM or MAX	Maximum response speed	FAST	Fast response speed (CV mode only)	SLOW	Slow response speed (CV mode only)
<NR2>	0.1, 0.2, 0.5, 1.0 (for CC or CR mode only)										
MINIMUM or MIN	Minimum response speed										
MAXIMUM or MAX	Maximum response speed										
FAST	Fast response speed (CV mode only)										
SLOW	Slow response speed (CV mode only)										
Return parameter	<ASCII string> Returns the response settings for all the applicable modes as a string										
Example	:CONFigure:RESPonse MAX Sets the response to the maximum.										

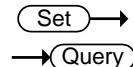
Query example :CONFigure:RESPonse?  
 >CV mode response:FAST, CC and CR mode their  
 response:1/1  
 Returns the response as CV=fast and CC, CR= 1/1.



### [:CONFigure]:CNTTime

Description	Turns the Count Time timer function on or off.	
Syntax	[:CONFigure]:CNTTime {<Boolean>  OFF   ON}	
Query Syntax	[:CONFigure]:CNTTime?	
Parameter/ Return parameter	OFF or 0  ON or 1	Turns the Count Time timer off.  Turns the Count Time timer on
Example	[:CONFigure]:CNTTime ON	Turns the Count Time timer on.

Query example :CONFigure]:CNTTime?  
 >ON  
 Count Time is turned on.



### [:CONFigure]:COTime

Description	Sets or queries the load cutoff time. A cutoff time of 0 seconds is the equivalent of disabling the cutoff time.	
Syntax	[:CONFigure]:COTime {<NR2>[S]   MINimum   MAXimum   OFF }	
Query Syntax	[:CONFigure]:COTime?	
Parameter	<NR2>[S]  OFF MINIMUM or MIN  MAXIMUM or MAX	Cut off time in seconds (1~3599999)  Turns the cutoff time off. Sets the cutoff time to the maximum Sets the cutoff time to the minimum

---

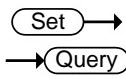
Return parameter	<code>&lt;NR2&gt;</code>	Returns the cutoff time
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---

Example	<code>:COTime MAX</code>
	Sets the cutoff time to the maximum.

---

Query example	<code>:COTime?</code>
	<code>&gt;3599999</code>
	The cutoff time is set to 3599999 seconds.




---

### `[:CONFige]:CRUnit`

---

Description	Sets or queries the CR mode setting units.	
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Syntax	<code>[:CONFige]:CRUnit {OHM MHO?}</code>	
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---

Query Syntax	<code>[:CONFige]:CRUnit?</code>	
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---

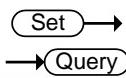
Parameter/ Return parameter	OHM	Set the units to ohms.
	MHO	Set the units to mho (conductance)

---

Example	<code>:CRUnit OHM</code>
	Sets the CR mode units to ohms.

---

Query example	<code>:CRUnit?</code>
	<code>&gt;OHM</code>
	The CR mode units are ohms.




---

### `:CONFige:DYNamic`

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Description	Sets the display units for when dynamic mode switching is used. Units can be selected from Percent and Value. See the user manual for further details. This command will also configure whether to switch between each level using timers or a set duty cycle.	
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Syntax	<code>:CONFige:DYNamic { VALue   PERCent   TIME   FDUTy }</code>	
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---

Query Syntax	<code>:CONFige:DYNamic?</code>	
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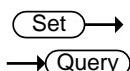
Parameter	VALUE or VAL	Set the units to Value.
	PERCENT or PERC	Set the units to Percent.

	TIME FDUTY or FUDT	Use timers for timing. Use duty cycle for timing.
Return parameter	<ASCII string>	Return a string containing the unit mode and the timing mode.

Example :CONFigure:DYNamic VALue  
Sets the dynamic mode units to value.

Query example :CONFigue:DYNamic?  
> Dynamic, ;Dynamic Level:Value, Dynamic  
Time:T1/T2

:CONFigure:MEMory



Description This command configures the how the files are recalled *in local mode* (using the front panel interface). By default when you try to recall a file or setting from memory, a message will appear asking you to press the Enter key to confirm each time you wish to recall. This command enables (SAFEty) or disables this feature (DIRect).

Syntax :CONFigure:MEMory {SAFEty | DIRect}

Query Syntax :CONFigure:MEMory?

Parameter	SAFETY or SAF DIRECT or DIR	Safety setting. Directly recall the chosen file.
-----------	--------------------------------	---

Return parameter	Safety Direct	Safety setting. Directly setting.
------------------	------------------	--------------------------------------

Example :CONFigure:MEMory SAFEtY  
Enables the safety setting.

Query example :CONFigure:MEMory?  
>Safety  
The safety setting is enabled.

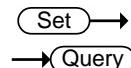
**:CONFigure:SHORt****Set****Query**

Description	Configures the short key.	
Syntax	:CONFigure:SHORt { TOGGLE   HOLD}	
Query Syntax	:CONFigure:SHORt?	
Parameter	HOLD TOGGLE or TOGG	Sets the button configuration to hold Sets the button configuration to toggle
Return parameter	Toggle Hold	Toggle Hold
Example	:CONFigure:SHORt TOGGLE Sets the Short key configuration to toggle.	
Query example	:CONFigure:SHORt? >Toggle The Short key is configured to toggle.	

**[:CONFigure]:GNG:SPECtest****Set****Query**

Description	Enables/Disables Go-NoGo testing (SPEC test = ON/SPEC test = OFF).	
Syntax	[:CONFigure]:GNG:SPECtest {<Boolean>} OFF   ON}	
Query Syntax	[:CONFigure]:GNG:SPECtest?	
Parameter/	OFF or 0	SPEC test = OFF
Return parameter	ON or 1	SPEC test = ON
Example	:GNG:SPECtest ON Turns Go-NoGo testing on.	
Query example	:GNG:SPECtest? >OFF Indicates that Go-NoGo testing is off.	

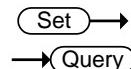
## [:CONFIGURE]:GNG:DTIME



Description	Sets or queries the Go-NoGo delay time.	
Syntax	[:CONFIGURE]:GNG:DTIME {<NR2>[ S ]   MINimum   MAXimum}	
Query Syntax	[:CONFIGURE]:GNG:DTIME?	
Parameter	<NR2>[S] MINIMUM or MIN MAXimum or MAX	Sets the Go-NoGo delay time in seconds (0.0~1.0) with 0.1 second resolution. Minimum delay time Maximum delay time
Return parameter	<NR2>	Returns the delay time in seconds.
Example	:GNG:DTIME 0.5	Sets the delay time to 0.5 seconds.

Query example	:GNG:DTIME? >0.5 The delay time is 0.5 seconds.	
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## [:CONFIGURE]:GNG:MODE



Description	Sets or queries the entry mode for the Go-NoGo settings. The entry mode determines whether the Go-NoGo limits are set as values or as a percentage value from a center reference value.	
Syntax	[:CONFIGURE]:GNG:MODE {PERCent   VALue}	
Query Syntax	[:CONFIGURE]:GNG:MODE?	
Parameter	PERCENT or PERC VALUE or VAL	Sets the entry mode to %. Sets the entry mode to value
Return parameter	Percent Value	% entry mode Value entry mode
Example	:GNG:MODE PERCENT	Sets the entry mode to %.

Query example :GNG:MODE?  
 >Percent  
 The entry mode is %.

## [:CONFigure]:GNG[:PASS]



Description Queries the Go-NoGo test result(s). This command can be used for all test modes (CC, CV, CR, CP).

## Query Syntax [:CONFigure]:GNG[:PASS]?

Return parameter	NG	No Go (fail)
	GO	Go (Pass)

Query example :GNG?  
 >GO  
 Returns the Go-NoGo test result.




## [:CONFigure]:GNG:H

Description Sets or queries the high voltage/current limit value. If the entry mode is set to value, the high voltage/current limit value units are in volts/amps. If the entry mode is set to percent, the high voltage/current limit value units are in percent.

## Syntax [:CONFigure]:GNG:H {&lt;NR2&gt;}

## Query Syntax [:CONFigure]:GNG:H?

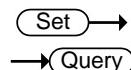
Parameter	<NR2>	Sets the high voltage/current limit value in volts/amps or in percent.
-----------	-------	--

Return parameter	<NR2>	Returns the high voltage/current limit value in volts/amps or as %.
------------------	-------	---

## Example :GNG:H 100.0

Sets the high voltage limit value to 100%.

Query example :GNG:H?  
 >100.0  
 Returns the high voltage limit value as 100.0%.



[:CONFigure]:GNG:L

Description Sets or queries the low voltage/current limit value. If the entry mode is set to value, the low voltage/current limit value units are in volts/amps. If the entry mode is set to percent, the low voltage/current limit value units are in percent.

Syntax [:CONFigure]:GNG:L {&lt;NR2&gt;}

Query Syntax [:CONFigure]:GNG:L?

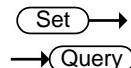
Parameter	<NR2>	Sets the low voltage/current limit value in volts/amps or in percent.
-----------	-------	---

Return parameter	<NR2>	Returns the low voltage/current limit value in volts/amps or as %.
------------------	-------	--

Example :GNG:L 10.0

Sets the low voltage limit value to 10%.

Query example :GNG:L?  
 >10.0  
 Returns the low voltage limit value as 10.0%.



[:CONFigure]:GNG:C

Description Sets or queries the center voltage/current limit value. The center voltage limit value is used as the center reference value when the entry mode is set to percent ([:CONFigure]:GNG:Mode=PERCent).

Syntax [:CONFigure]:GNG:C {&lt;NR2&gt;}

Query Syntax [:CONFigure]:GNG:C?

---

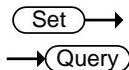
Parameter	<NR2>	Sets the center voltage/current limit value in volts/amps.
Return parameter	<NR2>	Returns the center voltage/current limit value in volts/amps.
Example	:GNC:C 10.0	Sets the center voltage/current limit value to 10V or A.

---

## Parallel Commands

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### [:CONFige]PARallel




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Description	Configures the unit for parallel operation, or queries its state. This command configures the unit as a Master or Slave, and configures how many slave units are connected if the unit is configured as a master.	
Syntax	[:CONFige]PARallel { OFF   MASTer   SLAve   P2 P3 P4 P5 B1 B2 B3 B4 }	
Query Syntax	[:CONFige]PARallel?	
Parameter	P2,P3,P4 or P5 B1,B2,B3 or B4 OFF MASTER or MAST SLAVE or SLAV	Number of connected slaves Number of connected booster Turn parallel mode off Sets the unit to Master Sets the unit to Slave
Return parameter	<ASCII string>	Returns an ASCII string with the mode of the unit (Master/Slave) and the number of connected devices.

---

---

Example	:PARallel MAST Sets the unit to Master.
	:PARallel B2 Configures the unit for use with 2 booster units.
Query example	:PARallel? >Mode:Master, Number:2  The unit is set to Master and there are connected slaves.

---

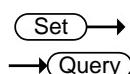
## Step Commands

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**[:CONFigure]:STEP:CCH**

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Description	Configures the step resolution for CC High Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.
-------------	--

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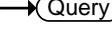
Syntax	[:CONFigure]:STEP:CCH {<NR2>[ A ]   MINimum   MAXimum }
Query Syntax	[:CONFigure]:STEP:CCH?

---

Parameter	<NR2>[ A ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
Return parameter	<ASCII string>	Returns the range and the step resolution.

Example	:STEP:CCH 0.002A  Sets the step resolution to 0.002A.
---------	---

Query example	:STEP:CCH? > CCH:0.002  Returns the step resolution (0.002A).
---------------	--

[:CONFigure]:STEP:CCM	 
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Description	Configures the step resolution for CC medium Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.
-------------	---

Syntax	[:CONFigure]:STEP:CCM {<NR2>[ A ]   MINimum   MAXimum }
--------	---

Query Syntax	[:CONFigure]:STEP:CCM?
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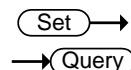
Parameter	<NR2>[ A ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
-----------	--	--

Return parameter	<ASCII string>	Returns the range and the step resolution.
------------------	----------------	--

Example	:STEP:CCM 0.0002A  Sets the step resolution to 0.0002A.
---------	---

Query example	:STEP:CCM? >CCM:0.0002  Returns the step resolution (0.0002A).
---------------	---

## [:CONFigure]:STEP:CCL



**Description** Configures the step resolution for CC low Range.  
Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.

**Syntax** [:CONFigure]:STEP:CCL {<NR2>[A ] | MINimum | MAXimum }

**Query Syntax** [:CONFigure]:STEP:CCL?

<b>Parameter</b>	<NR2>[ A ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
------------------	--	--

<b>Return parameter</b>	<ASCII string>	Returns the range and the step resolution.
-------------------------	----------------	--

**Example** :STEP:CCL 0.02mA

Sets the step resolution to 0.02mA.

**Query example** :STEP:CCL?  
> CCL:0.00002

Returns the step resolution (0.00002A).

## [:CONFigure]:STEP:CC



**Description** Returns the step resolution for each CC Mode range as a string.

**Query Syntax** [:CONFigure]:STEP:CC?

<b>Return parameter</b>	<ASCII string>	Returns the CCH, CCM and CCL step resolution settings.
-------------------------	----------------	--

**Query example** :STEP:CC?

>CCH:0.002, CCM:0.0002, CCL:0.00002

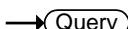
Returns the CC mode step resolution for each range.

## [:CONFigure]:STEP:CRH

 Set Query

Description	Configures the step resolution for CR High Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.		
Syntax	[:CONFigure]:STEP:CRH {<NR2>   MINimum   MAXimum }		
Query Syntax	[:CONFigure]:STEP:CRH?		
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Step resolution. [MHO] Minimum step resolution Maximum step resolution  Returns the range and the step resolution.	
Return parameter	<ASCII string>		
Example	:STEP:CRH 0.8 Sets the step resolution to 0.8U.		
Query example	:STEP:CRH? >CRH:0.8 Returns the step resolution (0.8U).		

## [:CONFigure]:STEP:CRM

 Set Query

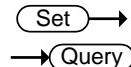
Description	Configures the step resolution for CR Medium Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.	
Syntax	[:CONFigure]:STEP:CRM {<NR2>   MINimum   MAXimum }	
Query Syntax	[:CONFigure]:STEP:CRM?	
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Step resolution. [MHO] Minimum step resolution Maximum step resolution  Returns the range and the step resolution.
Return parameter	<ASCII string>	

---

Example :STEP:CRM 0.08  
Sets the step resolution to 0.08U.

---

Query example :STEP:CRM?  
>CRM:0.08  
Returns the step resolution (0.08U).



Description Configures the step resolution for CR Low Range.  
Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.

---

Syntax [:CONFIGURE]:STEP:CRL {<NR2> | MINimum | MAXimum }

---

Query Syntax [:CONFIGURE]:STEP:CRL?

Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Step resolution. (MHO) Minimum step resolution Maximum step resolution
-----------	---	--

Return parameter <ASCII string>  
Returns the range and the step resolution.

---

Example :STEP:CRL 0.008  
Sets the step resolution to 0.008U.

---

Query example :STEP:CRL?  
>CRL:0.008  
Returns the step resolution (0.08U).

---

[:CONFIGURE]:STEP:CR →Query

---

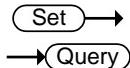
Description Returns the step resolution for each CR Mode range as a string.

---

Query Syntax [:CONFIGURE]:STEP:CR?

Return parameter <ASCII string>  
Returns the CRH, CRM and CRL step resolution settings.

**Query example** :STEP:CR?  
 > CRH:0.8, CRM:0.08, CRL:0.008  
 Returns the CR mode step resolution for each range.

**[:CONFigure]:STEP:CVH**

**Description** Configures the step resolution for CV High Range.  
 Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.

**Syntax** [:CONFigure]:STEP:CVH{<NR2>[ V ] | MINimum | MAXimum}

**Query Syntax** [:CONFigure]:STEP:CVH?

Parameter	<NR2>[ V ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
-----------	--	--

**Return parameter** <ASCII string>  
 Returns the range and the step resolution.

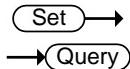
**Example** :STEP:CVH 0.01V

Sets the step resolution to 0.01V.

**Query example** :STEP:CVH?

> CVH:0.01

Returns the step resolution (0.01V).

**[:CONFigure]:STEP:CVL**

**Description** Configures the step resolution for CV Low Range.  
 Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.

**Syntax** [:CONFigure]:STEP:CVL{<NR2>[ V ] | MINimum | MAXimum}

**Query Syntax** [:CONFigure]:STEP:CVL?

**Parameter** <NR2>[ V ]  
 MINIMUM or MIN  
 Step resolution.  
 Minimum step resolution

	MAXIMUM or MAX	Maximum step resolution
Return parameter	<ASCII string>	Returns the range and the step resolution.
Example	:STEP:CVL 0.001V	Sets the step resolution to 0.001V.
Query example	:STEP:CVL? > CVH:0.001	Returns the step resolution (0.001V).

## [:CONFIGURE]:STEP:CV



Description	Returns the step resolution for each CV Mode range as a string.	
Query Syntax	[:CONFIGURE]:STEP:CV?	
Return parameter	<ASCII string>	Returns the CVH and CVL step resolution settings.
Query example	:STEP:CV? >CVH:0.01, CVL:0.001	Returns the CV mode step resolution for each range.

## [:CONFIGURE]:STEP:CPH

Description	Configures the step resolution for CP High Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.	
Syntax	[:CONFIGURE]:STEP:CPH {<NR2>[ W ]   MINimum   MAXimum }	
Query Syntax	[:CONFIGURE]:STEP:CPH?	
Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
Return parameter	<ASCII string>	Returns the range and the step resolution.

---

Example	:STEP:CPH 0.01 Sets the step resolution to 0.01W.
---------	--

---

Query example	:STEP:CPH? >CPH:0.01 Returns the step resolution (0.01W).
---------------	---

Set →  
→ Query

---

Description	Configures the step resolution for CP Medium Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.
-------------	---

---

Syntax	[:CONFigure]:STEP:CPM {<NR2>[ W ]   MINimum   MAXimum }
--------	---

---

Query Syntax	[:CONFigure]:STEP:CPM?
--------------	------------------------

---

Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
-----------	--	--

---

Return parameter	<ASCII string>	Returns the range and the step resolution.
------------------	----------------	--

---

Example	:STEP:CPM 0.001 Sets the step resolution to 0.001W.
---------	--

---

Query example	:STEP:CPM? >CPM:0.001 Returns the step resolution (0.001W).
---------------	---

Set →  
→ Query

---

Description	Configures the step resolution for CP Low Range. Note: The step resolution setting will be automatically rounded to the closest multiple of the base resolution.
-------------	--

---

Syntax	[:CONFigure]:STEP:CPL {<NR2>[ W ]   MINimum   MAXimum }
--------	---

---

Query Syntax	[:CONFigure]:STEP:CPL?	
Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	Step resolution. Minimum step resolution Maximum step resolution
Return parameter	<ASCII string>	Returns the range and the step resolution.
Example	:STEP:CPL 0.0001 Sets the step resolution to 0.0001W.	
Query example	:STEP:CPL? >CPM:0.0001 Returns the step resolution (0.0001W).	

## [:CONFigure]:STEP:CP

→ **Query**

Description	Returns the step resolution for each CP Mode range as a string.	
Query Syntax	[:CONFigure]:STEP:CP?	
Return parameter	<ASCII string>	Returns the CPH, CPM and CPL step resolution settings.
Query example	:STEP:CP? > CPH:0.01, CPM:0.001, CPL:0.0001 Returns the CP mode step resolution for each range.	

## External Control Commands

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### [:CONFigure]:EXTernal[:CONTrol]

Description	Configures the unit for external control or disables external control.	
Syntax	[:CONFigure]:EXTernal[:CONTrol] {OFF   VOLtage   RESistance   RINV }	
Related Commands	[:CONFigure]:EXTernal[:CONTrol]?	
Parameter	OFF VOLtage or VOLt  RESistance or RES  RINV	Disables external control Sets the unit to external voltage control Sets the unit to external resistance control Sets the unit to external resistance (inverted) control
Return Parameter	<ASCII string>	
Example	:EXTernal VOLT Turns external control voltage control on.	
Query example	:EXTernal? >voltage The unit uses external voltage control.	

### [:CONFigure]:EXTernal:LOADonin

Description	The LOADonin settings determine whether the load is turned on when an external switch is closed (LOW) or open (HIGH).
-------------	---

Syntax           [:CONFigure]:EXTernal:LOADonin {OFF | HIGH |LOW }

Related Commands           [:CONFigure]:EXTernal:LOADonin?

Parameter	OFF HIGH LOW	LoadOnIN = OFF LoadOnIN = OPEN LoadOnIN = CLOSE
-----------	--------------------	---

Return Parameter           <ASCII string>

Returns the Loadonin configuration as a string.

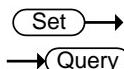
Example           :EXTernal:LOADonin OFF

Turns external control off.

Query example           :EXTernal:LOADonin?

> OFF

External control is off



### [:CONFigure]:EXTernal:SYNC

Description           Turns the external trigger sync mode on or off.

Syntax           [:CONFigure]:EXTernal:SYNC {<Boolean>}|OFF | ON }

Return Syntax           [:CONFigure]:EXTernal:SYNC?

Parameter	OFF or 0 ON or 1	!Turns external sync on. Turns external sync off.
-----------	---------------------	--

Return Parameter           <ASCII string>

Sync-Mode configuration as a string.

Example           :EXTernal:SYNC OFF

Turns Sync-mode off.

Query example           :EXTernal:SYNC?

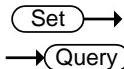
> OFF

Sync-mode I is off

## Mode Subsystem Commands

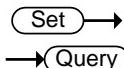
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### :MODE



Description	Sets the operating mode.	
Syntax	:MODE {CC   CR   CV   CP   CCCV   CRCV   CPCV}	
Query Syntax	:MODE?	
Parameter/Return parameter	CC	CC mode
	CR	CR mode
	CV	CV mode
	CP	CP mode
	CCCV	CC + CV mode
	CRCV	CR + CV mode
	CPCV	CP + CV mode
Example	:MODE CC Sets the mode to CC mode.	
Query example	:MODE? >CC Returns the operating mode (CC mode).	

### [:MODE]:CRANge

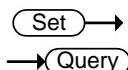


Description	Configures the current range for all the applicable operating modes.	
Syntax	[:MODE]:CRANge {HIGH   MIDDLE   LOW}	
Query Syntax	[:MODE]:CRANGe?	
Parameter	HIGH	High range
	MIDDLE or MIDD	Middle range

	LOW	Low range
Return parameter	High	High range
	Mid	Middle range
	Low	Low range

Example :CRANGE LOW  
Sets the current range to Low.

Query example :CRANGE?  
>Low  
The current range is set to Low.



### [:MODE]:VRANGE

Description Configures the voltage range for all the applicable operating modes.

Syntax [:MODE]:VRANGE {HIGH | LOW}

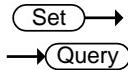
Query Syntax [:MODE]:VRANGE?

Parameter	HIGH	High range
	LOW	Low range

Return parameter	High	High range
	Low	Low range

Example :VRANGE LOW  
Sets the voltage range to Low.

Query example :VRANGE?  
>LOW  
The voltage range is set to Low.



### [:MODE]:RESPonse

Description Returns the CV Mode and the CC/CR Mode response speed. Fast is the default response speed.

Syntax [:MODE]:RESPonse { FAST | SLOW | 0.1 | 0.2 | 0.5 | 1 }

Query Syntax [:MODE]:RESPonse?

Parameter	FAST	Fast response
	SLOW	Slow response

	0.1	1/10 response
	0.2	1/5 response
	0.5	1/2 response
Note: There is no parameter for 1/3 response.		
Return parameter	<ASCII string>	Returns CV and the CC/CR response speed as a string.

Example	:RESPonse FAST	
	Sets the CV response to fast.	

Query example	:RESPonse?	
	> CV mode response:FAST, CC and CR mode their response:1/1	

[:MODE]:DYNamic  

Description	Sets or queries the switching mode. Dynamic is the default mode.	

Syntax	:MODE:DYNamic{ DYNAMIC   STATIC }	

Query Syntax	:MODE:DYNamic?	

Parameter	DYNAMIC or DYN STATIC or STAT	Set to Dynamic mode Set to Static mode

Return parameter	<ASCII string>	Returns the switching mode.

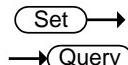
Example	:MODE:DYNamic DYN? Set the switching mode to dynamic	

Query example	:MODE:DYNamic? > Dynamic, ;Dynamic Level:Value, Dynamic Time:T1/T2 The switching mode is set to dynamic mode.	

## Current Subsystem Commands

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### :CURREnt[:VA]



**Description** Sets or queries the CC mode “A Value” (static mode) current. This command is applicable to static modes.

**Note:** A different current value can be set for each current range (High/Mid/Low).

**Note:** The [:VA] node can only be omitted when in static mode.

**Syntax** :CURREnt[:VA] {<NR2>[ A ] | MINimum | MAXimum }

**Query Syntax** :CURREnt[:VA]?

Parameter	<NR2>[A] MINIMUM or MIN MAXIMUM or MAX	“A Value” current value Minimum current level Maximum current level
-----------	--	---

Return parameter	<NR2>	Returns the “A Value” current value.
------------------	-------	--------------------------------------

**Example** :CURREnt:VA MIN

Sets the current value to the minimum.

Query example	:CURRent:VA? >1.0A	Returns the “A Value” current setting.
		Set → → Query
:CURRent:VB		
Description	Sets or queries the CC mode “B Value” (static mode) current. This command is applicable to static modes.  Note: A different current value can be set for each current range (High/Mid/Low).	
Syntax	:CURRent:VB {<NR2>[ A ]   MINimum   MAXimum }	
Query Syntax	:CURRent:VB?	
Parameter	<NR2>[A] MINIMUM or MIN MAXIMUM or MAX	“B Value” current value Minimum current level Maximum current level
Return parameter	<NR2>	Returns the “B Value” current value.
Example	:CURRent:VB MIN  Sets the current value to the minimum.	
Query example	:CURRent:VB? >1.0A  Returns the “B Value” current setting.	
		Set → → Query
:CURRent:SRATE		
Description	Sets or queries the current slew rate for CC static mode.	
Syntax	:CURRent:SRATE {<NR2>[ mA/uS ]   MINimum   MAXimum}	
Query Syntax	:CURRent:SRATE?	
Parameter	<NR2>[mA/us] MINIMUM or MIN MAXIMUM or MAX	Sets the slew rate in mA/uS Set to the highest slew rate Set to the lowest slew rate

Return parameter	<NR2>	Returns the slew rate in mA/uS.
------------------	-------	---------------------------------

Example	:CURREnt:SRATe MIN Sets the slew rate to the minimum.
---------	--

Query example	:CURREnt:SRATe? >5.0 Returns the slew rate as 5.0mA/uS.
---------------	---

:CURREnt:L1  

Description	Sets or queries the CC mode “Level 1” current. This command is only applicable to dynamic modes.  Note: A different current value can be set for each range (High/Mid/Low).
-------------	--

Syntax :CURREnt:L1 {<NR2>[ A ] | MINimum | MAXimum }

Query Syntax :CURREnt:L1?

Parameter	<NR2>[A] MINIMUM or MIN MAXIMUM or MAX	“Level1” current value Minimum current level Maximum current level
-----------	--	--

Return parameter	<NR2>	Returns the “Level1” current value.
------------------	-------	-------------------------------------

Example	:CURREnt:L1 MIN Sets the current value to the minimum.
---------	---

Query example	:CURREnt:L1? >1.0A Returns the “Level1” current setting.
---------------	--

:CURREnt:L2  

Description	Sets or queries the CC mode “Level2” current. This command is only applicable to dynamic modes.  Note: A different current value can be set for each range (High/Mid/Low).
-------------	--

Syntax	:CURREnt:L2 {<NR2>[ A ]   MINimum   MAXimum }	
Query Syntax	:CURREnt:L2?	
Parameter	<NR2>[A] MINIMUM or MIN MAXIMUM or MAX	“Level2” current value Minimum current level Maximum current level
Return parameter	<NR2>	Returns the “Level2” current value.

Example	:CURREnt:L2 MIN Sets the current value to the minimum.	
---------	---	--

Query example	:CURREnt:L2? >1.0A Returns the “Level2” current setting.	
---------------	--	--

:CURREnt:SET	 →	→ 
--------------	---	---

Description	Sets or queries the CC dynamic mode Set value when the dynamic units are set to Percent.  This command is only applicable in dynamic mode.	
-------------	--	--

Syntax	:CURREnt:SET{<NR2>[ A ]   MINimum   MAXimum }	
--------	---	--

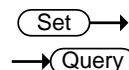
Query Syntax	:CURREnt:SET?	
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Related Commands	:CURREnt:LEVel	
------------------	----------------	--

Parameter	<NR2>[A] MINIMUM or MIN MAXIMUM or MAX	“Set” current value Minimum current level Maximum current level
Return parameter	<NR2>	Returns the “Set” current value.

Example	:CURREnt:SET MIN Sets the current value to the minimum.	
---------	--	--

Query example	:CURREnt:SET? >1.0A Returns the “Set” current setting.	
---------------	--	--

**:CURRent:LEVel**

**Description** Sets or queries the CC mode % level (percentage of the Set current value) when the dynamic mode units are set to Percent.

**Syntax** :CURRent:LEVel {<NR2>| MINimum | MAXimum }

**Query Syntax** :CURRent:LEVel?

**Related Commands** :CURRent:SET

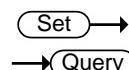
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	“% level” current value Minimum % current level Maximum % current level
Return parameter	<NR2>	Returns the “% level” current value.

**Example** :CURRent:LEVel MIN

Sets the % level current value to the minimum.

**Query example** :CURRent:LEVel?  
>50

Returns the “% Level” as 50 percent.

**:CURRent:RISE**

**Description** Sets the rising current slew rate for CC dynamic mode.

**Syntax** :CURRent:RISE {<NR2> | MINimum | MAXimum }

**Query Syntax** :CURRent:RISE?

**Related Commands** :CURRent:FALL

Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Rising current slew rate Minimum slew rate Maximum slew rate
Return parameter	<NR2>	Returns the rising current slew rate in mA/uS.

---

Example	:CURREnt:RISE MIN Sets the rising slew rate to the minimum.
---------	--

---

Query example	:CURREnt:RISE? >5000 Returns the rising slew rate as 5000mA/uS.
---------------	---

 Set Query**:CURREnt:FALL**


---

Description	Sets the falling current slew rate for CC dynamic mode.	
-------------	---	--

---

Syntax	:CURREnt:FALL {<NR2>   MINimum   MAXimum }	
--------	--	--

Query Syntax	:CURREnt:FALL?	
--------------	----------------	--

---

Related Commands	:CURREnt:FALL	
------------------	---------------	--

---

Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Falling current slew rate Minimum slew rate Maximum slew rate
Return parameter	<NR2>	Returns the falling current slew rate in mA/uS.

---

Example	:CURREnt:FALL MIN Sets the falling slew rate to the minimum.	
---------	---	--

---

Query example	:CURREnt:FALL? >5000 Returns the falling slew rate as 5000mA/uS.	
---------------	--	--

 Set Query**:CURREnt:T1**


---

Description	Sets the T1 timer settings for the CC dynamic mode.	
-------------	---	--

---

Syntax	:CURREnt:T1 {<NR2>[ S ]   MINimum   MAXimum }	
--------	---	--

Query Syntax	:CURREnt:T1?	
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---

Related Commands	:CURREnt:T2	
------------------	-------------	--

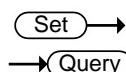
---

Parameter	<NR2>[ S] MINIMUM or MIN MAXIMUM or MAX	T1 timer setting in seconds Minimum time Maximum time
Return parameter	<NR2>	Returns the T1 timer time in seconds.

Example	:CURREnt:T1 0.200 Sets the T1 timer time to 200ms.
---------	---

Query example	:CURREnt:T1? >0.200 Returns the T1 timer time as 200mS.
---------------	---

:CURREnt:T2



Description	Sets the T2 timer settings for the CC dynamic mode.
-------------	---

Syntax	:CURREnt:T2 {<NR2>[ S ]   MINimum   MAXimum}
--------	--

Query Syntax	:CURREnt:T2?
--------------	--------------

Related Commands	:CURREnt:T1
------------------	-------------

Parameter	<NR2>[ S] MINIMUM or MIN MAXIMUM or MAX	T2 timer setting in seconds Minimum time Maximum time
Return parameter	<NR2>	Returns the T2 timer time in seconds.

Example	:CURREnt:T2 0.200 Sets the T2 timer time to 200ms.
---------	---

Query example	:CURREnt:T2? >0.200 Returns the T2 timer time as 200mS.
---------------	---

**:CURRent:FREquency****Set** →→ **Query**

**Description** Sets the CC dynamic mode switching frequency. This command along with the “:CURRent:Duty” command is used when the dynamic time setting is set to “Freq./Duty”.

This command is only applicable for dynamic mode.

**Syntax** :CURRent:FREquency {<NR2> | MINimum | MAXimum}

**Query Syntax** :CURRent:FREquency?

**Related Commands** :CURRent:DUTY

<b>Parameter</b>	<NR2>	Sets the switching frequency in hertz.
	MINIMUM or MIN	Minimum frequency
	MAXIMUM or MAX	Maximum frequency

<b>Return parameter</b>	<NR2>	Returns the frequency in hertz.
-------------------------	-------	---------------------------------

**Example** :CURRent:FREquency 60

Sets frequency to 60Hz.

**Query example** :CURRent:FREquency?  
>60

Returns the switching frequency (60Hz).

**Set** →→ **Query****:CURRent:DUTY**

**Description** Sets the positive duty cycle for the CC dynamic mode switching frequency. This command along with the “:CURRent:FREquency” command is used when the dynamic time setting is set to “Freq./Duty”.

This command is only applicable for dynamic mode.

---

Syntax :CURR<sup>ent</sup>:DUTY {<NR2> | MINimum | MAXimum}

---

Query Syntax :CURR<sup>ent</sup>:DUTY?

---

Related Commands :CURR<sup>ent</sup>:FREquency

---

Parameter	<NR2>	Sets the duty as a percentage.
	MINIMUM or MIN	Minimum duty
	MAXIMUM or MAX	Maximum duty

---

Return parameter	<NR2>	Returns the duty as a percentage.
------------------	-------	-----------------------------------

---

Example :CURR<sup>ent</sup>:DUTY 50  
Sets the duty to 50%.

---

Query example :CURR<sup>ent</sup>:DUTY?  
>50  
Returns the duty (50%).

## Resistance Subsystem Commands

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### :RESistance[:VA]

Description	Sets or queries the CR mode “A Value” resistance. This command is only applicable to static mode.  Note: A different value can be set for each current range (High/Mid/Low).
-------------	---

Note: The optional command node [:VA] can only be omitted when in static mode.

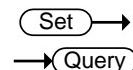
Syntax	:RESistance[:VA] {<NR2>   MINimum   MAXimum }		
Query Syntax	:RESistance[:VA]?		
Parameter	<NR2>	“A Value” resistance value (CR Unit: OHM )	
	<NR2>	“A Value” conductance value (CR Unit: MHO )	
	MINIMUM or MIN	Minimum resistance level	
	MAXIMUM or MAX	Maximum resistance level	
Return parameter	<NR2>		
	Returns the “A Value” resistance value.		

Example	:RESistance:VA MIN		
	Sets the resistance value to the minimum.		

Query example :RESistance:VA?  
 > 2.04082

Returns the “A Value” resistance setting.

:RESistance:VB



Description Sets or queries the CR mode “B Value” resistance.  
 This command is applicable to static mode only.  
 Note: A different value can be set for each current range (High/Mid/Low).

Syntax :RESistance:VB {<NR2> | MINimum | MAXimum }

Query Syntax :RESistance:VB?

Parameter	<NR2>  <NR2>  MINIMUM or MIN MAXIMUM or MAX	“B Value” resistance value (CR Unit: OHM ) “B Value” conductance value (CR Unit: MHO ) Minimum resistance level Maximum resistance level
Return parameter	<NR2>	Returns the “B Value” resistance value.

Example :RESistance:VB MIN

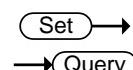
Sets the resistance value to the minimum.

Query example :RESistance:VB?

> 2.04082

Returns the “B Value” resistance setting.

:RESistance:SRATe



Description Sets or queries the current slew rate for CR static mode.

Syntax :RESistance:SRATe {<NR2> | MINimum | MAXimum }

Query Syntax :RESistance:SRATe?

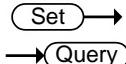
Parameter	<NR2>  MINIMUM or MIN	Sets the slew rate in mA/uS Set to the highest slew rate
-----------	-----------------------------	--

	MAXIMUM or MAX	Set to the lowest slew rate
Return parameter	<NR2>	Returns the slew rate in mA/uS.

Example	:RESistance:SRATE MIN Sets the slew rate to the minimum.
---------	---

Query example	:RESistance:SRATE? >5.0000 Returns the slew rate as 5mA/uS.
---------------	---

:RESistance:L1



Description	Sets or queries the CR mode “Level1” conductance. This command is only applicable to dynamic mode.  Note: A different value can be set for each current range (High/Mid/Low).
-------------	---

Syntax	:RESistance:L1 {<NR2>   MINimum   MAXimum }
--------	---

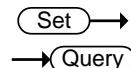
Query Syntax	:RESistance:L1?
--------------	-----------------

Parameter	<NR2>  <NR2>  MINIMUM or MIN MAXIMUM or MAX	“level1” resistance value (CR Unit: OHM )  “level1” conductance value (CR Unit: MHO )  Minimum resistance level Maximum resistance level
-----------	--	---

Return parameter	<NR2>	Returns the “level1” resistance value.
------------------	-------	--

Example	:RESistance:L1 MIN Sets the resistance value to the minimum.
---------	---

Query example	:RESistance:L1? > 2.04082 Returns the “level1” resistance setting.
---------------	--

**:RESistance:L2**

Description	Sets or queries the CR mode “level2” resistance. This command is applicable to dynamic mode only.  Note: A different value can be set for each current range (High/Mid/Low).
-------------	---

Syntax	<b>:RESistance:L2 {&lt;NR2&gt;   MINimum   MAXimum }</b>
--------	--

Query Syntax	<b>:RESistance:L2?</b>
--------------	------------------------

Parameter	<NR2>  <NR2>  MINIMUM or MIN MAXIMUM or MAX	“level2” resistance value (CR Unit: OHM ) “level2” conductance value (CR Unit: MHO ) Minimum resistance level Maximum resistance level
Return parameter	<NR2>	Returns the “Level2” resistance value.

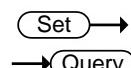
Example	<b>:RESistance:L2 MIN</b>
---------	---------------------------

Sets the resistance value to the minimum.

Query example	<b>:RESistance:L2?</b>
---------------	------------------------

> 2.04082

Returns the “Level2” resistance setting.

**:RESistance:SET**

Description	Sets or queries the CR dynamic mode Set value when the dynamic units are set to Percent.  This command is only applicable in dynamic mode.
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Syntax	<b>:RESistance:SET {&lt;NR2&gt;   MINimum   MAXimum }</b>
--------	---

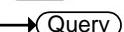
Query Syntax	<b>:RESistance:SET?</b>
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Related Commands	<b>:RESistance:LEVel</b>
---------------------	--------------------------

Parameter	<NR2> <NR2> MINIMUM or MIN MAXIMUM or MAX	"Set" resistance value (CR Unit: OHM ) "Set" conductance value (CR Unit: MHO ) Minimum conductance level Maximum conductance level
Return parameter	<NR2>	Returns the "Set" conductance value.

Example :RESistance:SET MIN  
Sets the conductance to the minimum.

Query example :RESistance:SET?  
>.200  
Returns the "Set" conductance setting in MHO.

:RESistance:LEVel  

Description Sets or queries the CR mode % level (percentage of the Set conductance value) when the dynamic mode units are set to Percent.

Syntax :RESistance:LEVel {<NR2> | MINimum | MAXimum }

Query Syntax :RESistance:LEVel?

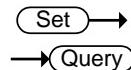
Related Commands :RESistance:SET

Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	"% level" conductance value Minimum % conductance level Maximum % conductance level
Return parameter	<NR2>	Returns the "% level" conductance value.

Example :RESistance:LEVel MIN  
Sets the % level conductance value to the minimum.

Query example :RESistance:LEVel?  
>50

Returns the “% Level” as 50 percent.



:RESistance:RISE

Description Sets the rising current slew rate for CR dynamic mode.

Syntax :RESistance:RISE {<NR2> | MINimum | MAXimum }

Query Syntax :RESistance:RISE?

Related Commands :RESistance:FALL

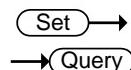
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Rising current slew rate [ mA/uS] Minimum slew rate Maximum slew rate
Return parameter	<NR2>	Returns the rising current slew rate in mA/uS.

Example :RESistance:RISE MIN

Sets the rising slew rate to the minimum.

Query example :RESistance:RISE?  
>50.000

Returns the rising slew rate as 50mA/uS.



:RESistance:FALL

Description Sets the falling current slew rate for CR dynamic mode.

Syntax :RESistance:FALL {<NR2> | MINimum | MAXimum }

Query Syntax :RESistance:FALL?

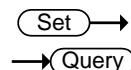
Related Commands :RESistance:RISE

Parameter	<NR2>	Falling current slew rate [ mA/uS]
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	MINIMUM or MIN MAXIMUM or MAX	Minimum slew rate Maximum slew rate
Return parameter	<NR2>	Returns the falling current slew rate in mA/uS.
Example	:RESistance:FALL MIN	Sets the falling slew rate to the minimum.
Query example	:RESistance:FALL? >50.000	Returns the falling slew rate as 50mA/uS.
		Set → → Query
<b>:RESistance:T1</b>		
Description	Sets the T1 timer settings for the CR dynamic mode.	
Syntax	:RESistance:T1 {<NR2>[ S ]   MINimum   MAXimum}	
Query Syntax	:RESistance:T1?	
Related Commands	:RESistance:T2	
Parameter	<NR2>[ S ]  MINIMUM or MIN MAXIMUM or MAX	T1 timer setting in seconds  Minimum time Maximum time
Return parameter	<NR2>	Returns the T1 timer time in seconds.
Example	:CURRrent:T1 0.200 :CURRrent:T1 0.200S :CURRrent:T1 200 mS  Sets the T1 timer time to 200ms.	
Query example	:CURRrent:T1? >0.200  Returns the T1 timer time as 200mS.	

---

:RESistance:T2



Description Sets the T2 timer settings for the CR dynamic mode.

Syntax :RESistance:T2 {<NR2>[ S ] | MINimum | MAXimum}

Query Syntax :RESistance:T2?

Related Commands :RESistance:T1

Parameter	<NR2>[ S ] MINIMUM or MIN MAXIMUM or MAX	T2 timer setting in seconds Minimum time Maximum time
-----------	--	---

Return parameter <NR2> Returns the T2 timer time in seconds.

Example :RESistance:T2 0.200

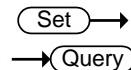
Sets the T2 timer time to 200ms.

Query example :RESistance:T2?  
>0.200

Returns the T2 timer time as 200mS.

---

:RESistance:FREquency



Description Sets the CR dynamic mode switching frequency. This command along with the “:RESistance:Duty” command is used when the dynamic time setting is set to “Freq./Duty”.

This command is only applicable for dynamic mode.

Syntax :RESistance:FREquency {<NR2> | MINimum | MAXimum}

Query Syntax :RESistance:FREquency?

Related Commands :RESistance:DUTY

Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Sets the switching frequency in hertz. Minimum frequency Maximum frequency
Return parameter	<NR2>	Returns the frequency in hertz.
Example	:RESistance:FREquency 60 Sets frequency to 60Hz.	
Query example	:RESistance:FREquency? >60	Returns the switching frequency (60Hz).
<b>:RESistance:DUTY</b>		Set → → Query
Description	Sets the positive duty cycle for the CR dynamic mode switching frequency. This command along with the “:RESistance:FREquency” command is used when the dynamic time setting is set to “Freq./Duty”.  This command is only applicable for dynamic mode.	
Syntax	:RESistance:DUTY {<NR2>   MINimum   MAXimum}	
Query Syntax	:RESistance:DUTY?	
Related Commands	:RESistance:FREquency	
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	Sets the duty as a percentage. Minimum duty Maximum duty
Return parameter	<NR2>	Returns the duty as a percentage.
Example	:RESistance:DUTY 50 Sets the duty to 50%.	

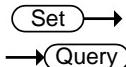
Query example    :RESistance:DUTY?  
                    >50

Returns the duty (50%).

## Voltage Subsystem Commands

:VOLTage[:VA].....	81
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### :VOLTage[:VA]



**Description** Sets or queries the CV mode “A Value” voltage or the +CV voltage value. Note: The same value applies for each current range (High/Mid/Low).

Note: The optional command node [:VA] can only be omitted when in static mode.

**Syntax** :VOLTage[:VA] {<NR2>[ V ] | MINimum | MAXimum }

**Query Syntax** :VOLTage[:VA]?

Parameter	<NR2>[ V ] MINIMUM or MIN MAXIMUM or MAX	“A Value” voltage value Minimum voltage level Maximum voltage level
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Return parameter	<NR2>	Returns the “A Value” voltage value.
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**Example** :VOLTage:VA MIN

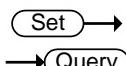
Sets the voltage value to the minimum.

**Query example** :VOLTage:VA?

>1.0V

Returns the “A Value” voltage setting.

### :VOLTage:VB



**Description** Sets or queries the CV mode “B Value”. Note: The same value applies for each current range (High/Mid/Low).

**Syntax** :VOLTage:VB {<NR2>[ V ] | MINimum | MAXimum }

**Query Syntax** :VOLTage:VB?

Parameter	<NR2>[ V ]	“B Value” voltage value
-----------	------------	-------------------------

	MINIMUM or MIN MAXIMUM or MAX	Minimum voltage level Maximum voltage level
Return parameter	<NR2>	Returns the “B Value” voltage value.

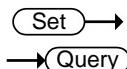
Example :VOLTage:VB MIN  
Sets the voltage value to the minimum.

Query example :VOLTage:VB?  
>1.0V  
Returns the “B Value” voltage setting.

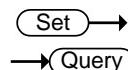
## Power Subsystem Commands

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### :POWER[:VA]



Description	Sets or queries the CP mode “A Value” power. This command is applicable to static mode only.  Note: A different “A Value” can be set for different current ranges.	
	Note: The [:VA] node can only be omitted when in static mode.	
Syntax	:POWER[:VA] {<NR2>[ W ]   MINimum   MAXimum }	
Query Syntax	:POWER[:VA]?	
Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	“A Value” power value Minimum power level Maximum power level
Return parameter	<NR2>	Returns the “A Value” power value.
Example	:POWER:VA MIN  Sets the power value to the minimum.	
Query example	:POWER:VA? >10W  Returns the “A Value” power setting.	

**:POWer:VB**

Description	Sets or queries the CP mode “B Value” power. This command is only applicable to static mode.  Note: A different “B Value” can be set to different current ranges.
-------------	---

Syntax            :POWer:VB {<NR2>[ W ] | MINimum | MAXimum }

Query Syntax    :POWer:VB?

Parameter	<NR2>[W] MINIMUM or MIN MAXIMUM or MAX	“B Value” power value Minimum power level Maximum power level
Return parameter	<NR2>	Returns the “B Value” power value.

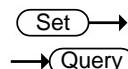
Example          :POWer:VB MIN

Sets the power value to the minimum.

Query example   :POWer:VB?

>10W

Returns the “B Value” power setting.

**:POWer:L1**

Description	Sets or queries the CP mode “Level1” power. This command is applicable to dynamic mode only.  Note: A different “Level1” value can be set for different current ranges.
-------------	---

Syntax            :POWer:L1 {<NR2>[ W ] | MINimum | MAXimum }

Query Syntax    :POWer:L1?

Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	“Level1” power value Minimum power level Maximum power level
Return parameter	<NR2>	Returns the “Level1” power value.

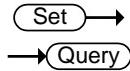
---

Example	:POWer:L1 MIN Sets the power value to the minimum.
---------	---

---

Query example	:POWer:L1? >10W Returns the “Level1” power setting.
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**:POWer:L2**




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Description	Sets or queries the CP mode “Level2” power. This command is only applicable to dynamic mode.  Note: A different “Level2” value can be set to different current ranges.
-------------	--

**Syntax** :POWer:L2 {<NR2>[ W ] | MINimum | MAXimum }

**Query Syntax** :POWer:L2?

Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	“Level2” power value Minimum power level Maximum power level
Return parameter	<NR2>	Returns the “Level2” power value.

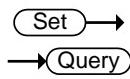
---

Example	:POWer:L2 MIN Sets the power value to the minimum.
---------	---

---

Query example	:POWer:L2? >10W Returns the “Level2” power setting.
---------------	---

**:POWer:SET**




---

Description	Sets or queries the CP dynamic mode Set value when the dynamic units are set to Percent.  This command is only applicable in dynamic mode.
-------------	--

**Syntax** :POWer:SET {<NR2>[ W ] | MINimum | MAXimum }

**Query Syntax** :POWer:SET?

Related Commands	:POWer:LEVel	
Parameter	<NR2>[ W ] MINIMUM or MIN MAXIMUM or MAX	“Set” power value Minimum power level Maximum power level
Return parameter	<NR2>	Returns the “Set” power value.
Example	:POWer:SET MIN Sets the power value to the minimum.	
Query example	:POWer:SET? >10W Returns the “Set” power setting.	
<hr/>		
:POWer:LEVel	<pre> graph LR     Set((Set)) --&gt; Query((Query))     </pre>	
Description	Sets or queries the CP mode % level (percentage of the Set power value) when the dynamic mode units are set to Percent.	
Syntax	:POWer:LEVel {<NR2>   MINimum   MAXimum }	
Query Syntax	:POWer:LEVel?	
Related Commands	:POWer:Set	
Parameter	<NR2> MINIMUM or MIN MAXIMUM or MAX	“% level” power value Minimum % power level Maximum % power level
Return parameter	<NR2>	Returns the “% level” current value.
Example	:POWer:LEVel MIN Sets the % level power value to the minimum.	
Query example	:POWer:LEVel? >50 Returns the “% Level” as 50 percent.	

**:POWER:T1****Set****Query**

Description	Sets the T1 timer settings for the CP dynamic mode.				
Syntax	:POWER:T1 {<NR2>[ S ]   MINimum   MAXimum}				
Query Syntax	:POWER:T1?				
Related Commands	:POWER:T2				
Parameter	<NR2>	T1 timer setting in seconds			
	MINIMUM or MIN	Minimum time			
	MAXIMUM or MAX	Maximum time			
Return parameter	<NR2>	Returns the T1 timer time in S.			
Example	:POWER:T1 0.200 Sets the T1 timer time to 200ms.				
Query example	:POWER:T1? >0.200 Returns the T1 timer time as 200mS.				

**:POWER:T2****Set****Query**

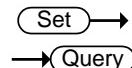
Description	Sets the T2 timer settings for the CP dynamic mode.		
Syntax	:POWER:T2 {<NR2>  MINimum   MAXimum}		
Query Syntax	:POWER:T2?		
Related Commands	:POWER:T1		
Parameter	<NR2>	T2 timer setting in seconds	
	MINIMUM or MIN	Minimum time	
	MAXIMUM or MAX	Maximum time	
Return parameter	<NR2>	Returns the T2 timer time in mS.	

---

Example :POWER:T2 0.200  
Sets the T2 timer time to 200ms.

---

Query example :POWER:T2?  
>0.200  
Returns the T2 timer time as 200mS.




---

:POWER:FREQUENCY

---

Description Sets the CP dynamic mode switching frequency.  
This command along with the “:POWER:Duty” command is used when the dynamic time setting is set to “Freq./Duty”.  
This command is only applicable for dynamic mode.

---

Syntax :POWER:FREQUENCY {<NR2> | MINimum | MAXimum}

---

Query Syntax :POWER:FREQUENCY?

---

Related Commands :POWER:Duty

---

Parameter	<NR2>  MINIMUM or MIN MAXIMUM or MAX	Sets the switching frequency in hertz. Minimum frequency Maximum frequency
Return parameter	<NR2>	Returns the frequency in hertz.

---

Example :POWER:FREQUENCY 60  
Sets the frequency to 60Hz.

---

Query example :POWER:FREQUENCY?  
>60  
Returns the switching frequency (60Hz).

 Set Query**:POWer:DUTY**

Description	Sets the duty cycle for the CP dynamic mode switching frequency. This command along with the “:POWer:FREquency” command is used when the dynamic time setting is set to “Freq./Duty”.  This command is only applicable for dynamic mode.	
Syntax	:POWer:DUTY {<NR2>   MINimum   MAXimum}	
Query Syntax	:POWer:DUTY?	
Related Commands	:POWer:FREquency	
Parameter	<NR2>  MINIMUM or MIN  MAXIMUM or MAX	Sets the duty as a percentage.  Minimum duty  Maximum duty
Return parameter	<NR2>	Returns the duty as a percentage.
Example	:POWer:DUTY 50  Sets the duty to 50%.	
Query example	:POWer:DUTY? >50  Returns the duty (50%).	

## Error Messages

The following error messages may be encountered when reading the error queue.

---

Error Code and string	Description
<b>Command Errors</b>	
0 NoError	No error
-100 Command Error	This is the generic syntax error for devices that cannot detect more specific errors.
-101 Invalid character	A syntactic element contains a character which is invalid for that type.
-102 Syntax error	An unrecognized command or data type was encountered.
-103 Invalid separator	The parser was expecting a separator and encountered an illegal character.
-104 Data type error	The parser recognized a data element different than the one allowed.
-105 GET not allowed	A Group Execute Trigger was received within a program message.
-108 Parameter not allowed	More parameters were received than expected for the header.
-109 Missing parameter	Fewer parameters were received than required for the header.
-110 Command header error	An error was detected in the header.

-111 Header separator error	A character which is not a legal header separator was encountered while parsing the header.
-112 Program mnemonic too long	The header contains more than twelve characters.
-113 Undefined header	The header is syntactically correct, but it is undefined for this specific device.
-114 Header suffix out of range	The value of a numeric suffix attached to a program mnemonic.
-115 Unexpected number of parameters	The number of parameters received does not correspond to the number of parameters expected.
-120 Numeric data error	This error is generated when parsing a data element which appears to be numeric, including the nondecimal numeric types.
-121 Invalid character in number	An invalid character for the data type being parsed was encountered.
-123 Exponent too large	The magnitude of the exponent was larger than 32000.
-124 Too many digits	The mantissa of a decimal numeric data element contained more than 255 digits excluding leading zeros.
-128 Numeric data not allowed	A legal numeric data element was received, but the device does not accept one in this position for the header
-130 Suffix error	This error, as well as errors -131 through -139, are generated when parsing a suffix.

-131 Invalid suffix	The suffix does not follow the syntax described in IEEE 488.2 or the suffix is inappropriate for this device.
-134 Suffix too long	The suffix contained more than 12 characters.
-138 Suffix not allowed	A suffix was encountered after a numeric element which does not allow suffixes.
-140 Character data error	This error is generated when parsing a character data element.
-141 Invalid character data	Either the character data element contains an invalid character or the particular element received is not valid for the header.
-144 Character data too long	The character data element contains more than twelve characters
-148 Character data not allowed	A legal character data element was encountered where prohibited by the device.
-150 String data error	This error is generated when parsing a string data element.
-151 Invalid string data	A string data element was expected, but was invalid for some reason.
-158 String data not allowed	A string data element was encountered but was not allowed by the device at this point in parsing.
-160 Block data error	This error is generated when parsing a block data element.
-161 Invalid block data	A block data element was expected, but was invalid for some reason.

-168 Block data not allowed	A legal block data element was encountered but was not allowed by the device at this point in parsing.
-170 Expression error	This error is generated when parsing an expression data element.
-171 Invalid expression	The expression data element was invalid.
-178 Expression data not allowed	A legal expression data was encountered but was not allowed by the device at this point in parsing.
-180 Macro error	This error is generated when defining a macro or executing a macro.
-181 Invalid outside macro definition	Indicates that a macro parameter placeholder (\$<number>) was encountered outside of a macro definition.
-183 Invalid inside macro definition	Indicates that the program message unit sequence, sent with a *DDT or *DMC command, is syntactically invalid.
-184 Macro parameter error	Indicates that a command inside the macro definition had the wrong number or type of parameters.

### Execution Errors

-200 Execution error	This is the generic syntax error for devices that cannot detect more specific errors. This code indicates only that an Execution Error as defined in IEEE 488.2 has occurred.
-201 Invalid while in local	Indicates that a command is not executable while the device is in local due to a hard local control
-202 Settings lost due to rtl	Indicates that a setting associated with a hard local control was lost when the device changed to LOCS from REMS or to LWLS from RWLS.
-203 Command protected	Indicates that a legal password-protected program command or query could not be executed because the command was disabled.
-210 Trigger error	
-211 Trigger ignored	Indicates that a GET, *TRG, or triggering signal was received and recognized by the device but was ignored because of device timing considerations.
-212 Arm ignored	Indicates that an arming signal was received and recognized by the device but was ignored.
-213 Init ignored	Indicates that a request for a measurement initiation was ignored as another measurement was already in progress.

-214 Trigger deadlock	Indicates that the trigger source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
-215 Arm deadlock	Indicates that the arm source for the initiation of a measurement is set to GET and subsequent measurement query is received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error.
-220 Parameter error	Indicates that a program data element related error occurred.
-221 Settings conflict	Indicates that a legal program data element was parsed but could not be executed due to the current device state.
-222 Data out of range	Indicates that a legal program data element was parsed but could not be executed because the interpreted value was outside the legal range as defined by the device.
-223 Too much data	Indicates that a legal program data element of block, expression, or string type was received that contained more data than the device could handle due to memory or related device-specific requirements.

-224 Illegal parameter value	Used where an exact value, from a list of possibilities, was expected.
-225 Out of memory.	The device has insufficient memory to perform the requested operation.
-226 Lists not same length.	Attempted to use LIST structure having individual LIST's of unequal lengths.
-230 Data corrupt or stale	Possibly invalid data; new reading started but not completed since last access.
-231 Data questionable	Indicates that measurement accuracy is suspect.
-232 Invalid format	Indicates that a legal program data element was parsed but could not be executed because the data format or structure is inappropriate.
-233 Invalid version	Indicates that a legal program data element was parsed but could not be executed because the version of the data is incorrect to the device.
-240 Hardware error	Indicates that a legal program command or query could not be executed because of a hardware problem in the device.
-241 Hardware missing	Indicates that a legal program command or query could not be executed because of missing device hardware.
-250 Mass storage error	Indicates that a mass storage error occurred.

-251 Missing mass storage	Indicates that a legal program command or query could not be executed because of missing mass storage.
-252 Missing media	Indicates that a legal program command or query could not be executed because of a missing media.
-253 Corrupt media	Indicates that a legal program command or query could not be executed because of corrupt media.
-254 Media full	Indicates that a legal program command or query could not be executed because the media was full.
-255 Directory full	Indicates that a legal program command or query could not be executed because the media directory was full.
-256 File name not found	Indicates that a legal program command or query could not be executed because the file name on the device media was not found.
-257 File name error	Indicates that a legal program command or query could not be executed because the file name on the device media was in error.
-258 Media protected	Indicates that a legal program command or query could not be executed because the media was protected.
-260 Expression error	Indicates that a expression program data element related error occurred.

-261 Math error in expression	Indicates that a syntactically legal expression program data element could not be executed due to a math error.
-270 Macro error	Indicates that a macro-related execution error occurred.
-271 Macro syntax error	Indicates that that a syntactically legal macro program data sequence, according to IEEE 488.2 could not be executed due to a syntax error within the macro definition.
-272 Macro execution error	Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition.
-273 Illegal macro label	Indicates that the macro label defined in the *DMC command was a legal string syntax, but could not be accepted by the device.
-274 Macro parameter error	Indicates that the macro definition improperly used a macro parameter placeholder.
-275 Macro definition too long	Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle.
-276 Macro recursion error	Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive.

-277 Macro redefinition not allowed	Indicates that a syntactically legal macro label in the *DMC command could not be executed because the macro label was already defined.
-278 Macro header not found	Indicates that a syntactically legal macro label in the *GMC? query could not be executed because the header was not previously defined.
-280 Program error	Indicates that a downloaded program-related execution error occurred.
-281 Cannot create program	Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory.
-282 Illegal program name	The name used to reference a program was invalid.
-283 Illegal variable name	An attempt was made to reference a nonexistent variable in a program.
-284 Program currently running	Certain operations dealing with programs may be illegal while the program is running.
-285 Program syntax error	Indicates that a syntax error appears in a downloaded program.
-286 Program runtime error	
-290 Memory use error	Indicates that a user request has directly or indirectly caused an error related to memory or <data_handle>s, this is not the same as "bad" memory.
-291 Out of memory	

- 292 Referenced name does not exist
- 293 Referenced name already exists
- 294 Incompatible type      Indicates that the type or structure of a memory item is inadequate.

**Device Specific Errors**

- 300 Device-specific error      This is the generic device-dependent error for devices that cannot detect more specific errors.
- 310 System error      Indicates that some error, termed "system error" by the device, has occurred.
- 311 Memory error      Indicates some physical fault in the device's memory, such as parity error.
- 312 PUD memory lost      Indicates that the protected user data saved by the \*PUD command has been lost.
- 313 Calibration memory lost      Indicates that nonvolatile calibration data used by the \*CAL? command has been lost.
- 314 Save/recall memory lost      Indicates that the nonvolatile data saved by the \*SAV? command has been lost.
- 315 Configuration memory lost      Indicates that nonvolatile configuration data saved by the device has been lost.

-320 Storage fault	[Indicates that the firmware detected a fault when using data storage. This error is not an indication of physical damage or failure of any mass storage element.]
-321 Out of memory	An internal operation needed more memory than was available.
-330 Self-test failed	
-340 Calibration failed	
-350 Queue overflow	A specific code entered into the queue in lieu of the code that caused the error. This code indicates that there is no room in the queue and an error occurred but was not recorded.
-360 Communication error	This is the generic communication error.
-361 Parity error in program message	Parity bit not correct when data received.
-362 Framing error in program message	A stop bit was not detected when data was received.
-363 Input buffer overrun	Software or hardware input buffer on serial port overflows with data caused by improper or nonexistent pacing.
-365 Time out error	This is a generic device-dependent error.

**Query Errors**

-400 Query error	This is the generic query error.
-410 Query INTERRUPTED	Indicates that a condition causing an INTERRUPTED Query error occurred.

-420 Query UNTERMINATED	Indicates that a condition causing an UNTERMINATED Query error occurred.
-430 Query DEADLOCKED	Indicates that a condition causing an DEADLOCKED Query error occurred.
-440 Query UNTERMINATED after indefinite response	Indicates that a query was received in the same program message after a query requesting an indefinite response was executed

**Power On Event Commands**

-500 Power on	The instrument has detected an off to on transition in its power supply.
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**User Request Event**

-600 User request	The instrument has detected the activation of a user request local control.
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**Request Control Event**

-700 Request control	The instrument requested to become the active IEEE 488.1 controller-in-charge.
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**Operation Complete Event**

-800 Operation complete	The instrument has completed all selected pending operations in accordance with the IEEE 488.2 synchronization protocol.
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